CHAMBER TECHNOLOGY CONCEPTS FOR INERTIAL FUSION ENERGY

Wayne R. Meier
Lawrence Livermore National Laboratory
Livermore, CA 94551 USA

Mohamed A. Abdou
University of California, Los Angeles
Los Angeles, CA 90024 USA

The most serious challenges in the design of chambers for inertial fusion energy (IFE) are 1) protecting the first wall from fusion energy pulses on the order of several hundred megajoules released in the form of x rays, target debris, and high energy neutrons, and 2) operating the chamber at a pulse repetition rate of 5-10 Hz (i.e., re-establishing the wall protection and chamber conditions needed for beam propagation to the target between pulses). In meeting these challenges, designers have capitalized on the ability to separate the fusion burn physics from the geometry and environment of the fusion chamber. Most recent conceptual designs use gases or flowing liquids inside the chamber. Thin liquid layers of molten salt or metal and low pressure, high-z gases can protect the first wall from x rays and target debris, while thick liquid layers have the added benefit of protecting structures from fusion neutrons thereby significantly reducing the radiation damage and activation. Various schemes have been proposed to assure chamber clearing and renewal of the protective features at the required pulse rate. Representative chamber concepts are described, and key technical feasibility issues are identified for each class of chamber. Experimental activities (past, current, and proposed) to address these issues and technology development needs are discussed.

Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.